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Digital-Based Pop Up Book To Improve Toothbrushing Behavior in Deaf Children

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ABSTRACT

Deaf children are those with limited hearing, which affects the reception of information, including knowledge about dental and oral hygiene. As a result, many deaf children have moderate to poor debris index scores. This is largely due to a lack of awareness about the importance of maintaining dental hygiene. One strategy to address this issue is using "digital-based pop up book media," which offers engaging and enjoyable education during the learning process. This study aimed to develop and assess the effectiveness of such media in improving toothbrushing behavior and reducing the debris index in deaf children.This research was conducted using a research and development (R&D) approach with a quasi-experimental pretest-posttest group design. The sample consisted of 22 deaf children, with 11 in the intervention group (SLBN Semarang) and 11 in the control group (SLBN Ungaran), selected using the Slovin formula. Data were analyzed using the Intraclass Correlation Coefficient, Shapiro-Wilk, Paired t-test, Wilcoxon, and Mann Whitney tests.Results showed significant improvements in the intervention group. Knowledge scores ($p = 0.002$, $\Delta = 1.36$), attitudes ($p = 0.004$, $\Delta = 1.36$), skills ($p = 0.007$, $\Delta = 2.91$), and debris index ($p = 0.000$, $\Delta = 1.364$) improved more significantly compared to the control group.In conclusion, digital-based pop up book media is a feasible and effective method to enhance toothbrushing behavior and reduce the debris index among deaf children.

Keyword : Deaf Children; Brushing Teeth; Digital Based Pop Up Book Media

Introduction

Deaf children are children who have limitations in hearing so they cannot pick up on various stimuli, especially in the sense of hearing, as a result of which deaf children have speech barriers so they are often called speech-impaired.[1] Limitations in verbal communication make deaf children tend to get along with others and withdraw from the hearing environment.[2]

Data from the World Health Organization (WHO) in 2019, states that there are around 466 million people in the world with hearing loss, including children, 34 million. The percentage of people with disabilities in Indonesia based on type in 2019, deaf disabilities was 7.03%. The prevalence of hearing loss at ≥ age 5 years by province in 2013, Central Java province was in the top three at 3.1%.[3]

The limited information received by deaf children through the sense of hearing causes the development of their intelligence to be delayed, in this case it can be seen from the health condition of the teeth and mouth of deaf children.

Deaf children mostly have moderate to poor dental and oral hygiene. Research conducted at the Bandung Regency Special School (SLB) in 2021 stated that the OHI-S criteria for deaf children, namely the OHI-S criteria are 45.5% moderate and 54.5% poor. The results of research at the Manado Special School (SLB) stated that the OHI-S of deaf children had good criteria of 60% and medium as much as 40%.[4]

The condition of dental and oral hygiene of deaf children cannot be separated from various

influencing factors such as limitations in communication as a result of the hearing loss they experience, this can cause obstacles in gaining knowledge about dental and oral health which will later determine the child's attitude and actions in maintaining the cleanliness of his teeth and mouth.[5]

The simplest prevention of dental and oral health problems is brushing your teeth.[6] Basic Health Research Data (RISKESDAS) shows that children aged 15-25 years in 2018 who brushed their teeth correctly were 3.3%, and in the Central Java Province area by 2.2%.[7]

Some of the government's efforts to improve the dental and oral health of elementary school children, both normal children and children with special needs, are the School Dental Health Business (UKGS). The School Dental Health Business (UKGS) is a school dental health effort aimed at school children in the school environment from the level of promotive, preventive to plenary services.[8]

Promotive efforts through dental health counseling are able to increase a person's knowledge in maintaining dental health. Counseling using tools can make it easier to deliver material so that the target can receive the message conveyed.

In the modern era, the development of technology-based and information-based learning media is developing rapidly, making it a necessity.[9] The use of an application using a smartphone certainly has advantages compared to media that has been used frequently or conventional media. Existing applications can support children's knowledge, attitudes, and skills in maintaining the health of their teeth and mouth, so that their dental hygiene status can also change. The increasingly attractive physical appearance on the media will be more motivated to learn, so that it can affect the learning outcomes. The beauty, attractiveness and interactivity in a child's learning medium make children not saturated and receive the material well.[10]

Over time, technology is developing, making deaf children understand and understand technology, especially the characteristics of deaf children are not much different from normal children. Technology such as android-based applications that stand out in terms of visuals, makes deaf children able to understand and use applications, because deaf children rely on the sense of sight.[11]

Previous media there was a conventional pop up book where a book that has moving parts or has 3-dimensional elements, the display of images on a conventional pop up book can move when the page is opened or shifted.[12] However, this media has a disadvantage, namely a large shape like a book and a high risk of damage because the material is made of paper so that it is easy to tear if used repeatedly and for a long time, and also pop up book media is conventionally made with a focus on one topic so that the amount of material that can be presented in one pop up book is conventionally limited.[13]

Therefore, the researcher wants to conduct research by providing counseling on brushing teeth using digital-based pop up books as an intervention group and conventional pop up books as a control group against changes in toothbrushing behavior in deaf students of SLBN Semarang and SLBN Ungaran.

Methods

The research method used is Research and Development (R&D) with Quasi Experiment pre-test and post-test with control group design. The subjects in this study were SMALB deaf students of SLBN Semarang for the intervention group of 11 deaf children and SMALB deaf students of SLBN Ungaran for the control group of 11 deaf children. The intervention group was given a digital-based pop up book and the control group was given a conventional pop up book. The data collection techniques in this study are interviews, questionnaires and observations. The stages of implementing this research start from collecting information (interviews with the Education Office, school principals, dental health workers, SMALB teachers, observations, literature studies), model design, expert validation and revision as well as model testing carried out by measuring using questionnaires regarding knowledge, attitudes, toothbrushing skills and debris index. Respondents were measured on knowledge, attitudes, toothbrushing skills and debris index before being given the intervention, then respondents were given a "digital-based pop up book" intervention in the intervention group and a conventional pop up book in the control group for 21 days. Furthermore, respondents were re-measured regarding knowledge, attitudes, brushing skills and debris index. Sampling was done using purposive sampling. Data analysis was carried out with univariate analysis and bivariate analysis with the Shapiro-Wilk normality test whose data results were abnormally distributed followed by using

Wilcoxon and Mann Whitney tests to determine the effectiveness between variables.

Results and Discussion

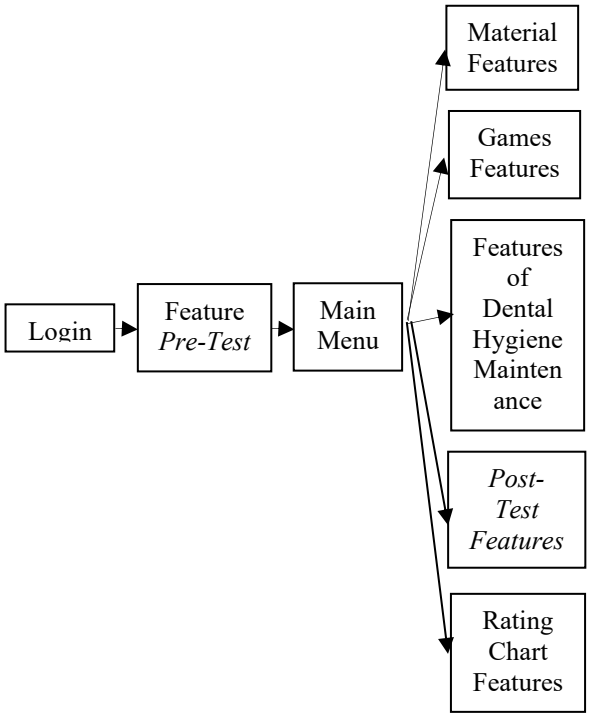
A. Information Collection

The interview method is used to collect information related to problems that commonly occur in the target group. This is done to further explore and seek consideration in developing a digital-based pop up book model for deaf children. Interviews were conducted with the Education Office, school principals, dental health workers and SMALB teachers. The conclusions of the interview were obtained as follows:

1. Deaf children are children who have limitations in mastering vocabulary and communication with the community. The characteristics of deaf children are having communication between deaf children using sign language, having a high sense of suspicion of others and relying on the sense of sight in all aspects.
2. The learning process that is suitable for deaf children, especially those aged 15 years and above, is with small groups such as discussions and media that are often used, namely writing in order to improve vocabulary and in the learning process, deaf children are accustomed to using oral language so that their expectations can be more easily adapted to society.
3. The current learning process makes it possible to use learning media using technology in the aspect of using technology in a positive way, of course, especially schools can make it simple and interesting so that it is hoped that it will make it easier for deaf children to use.
4. The government has a program for maintaining dental and oral hygiene, namely UKGS. Several parties, such as health centers and schools, have held dental and oral hygiene maintenance programs but are not optimal, because one of the factors is the limited number of health workers
5. The educational efforts that have been carried out for deaf children are in the form of the UKGS program where there is counseling, teeth brushing demonstrations and examinations. Currently, the UKGS program is still carried out the same as normal children, only slightly different in terms of approach, especially for deaf children to communicate using sign language.

B. Design and Build Models

The preparation of this "Digital-Based Pop Up Book" was built using the development of the ADDIE system, namely analysis, design, development, implementation and evaluation. The output of the "Digital-Based Pop Up Book" is developed with the following menu display:



Picture 1. Design a "Digital-Based Pop Up Book" Model

The description of the design of the "Digital-Based Pop Up Book" model is described as follows:

Login

Respondents fill in their identity including name, age and gender then click log in. In the login menu, there is a question mark icon containing instructions on how to install and use a digital-based pop up book.

Feature Pre-Test

Before entering the main menu, respondents must fill out the pre-test first, done only once when logging in, there are 3 parts, namely knowledge in the form of a questionnaire with 12 questions, attitude in the form of a checklist with 8 questions and skills in the form of a checklist with 10 questions.

Main Menu

The main menu display has several features, namely, material features, games features, dental hygiene maintenance features, post-test features, and finally the adjustment chart feature. On the

main menu (home page) there is a question mark icon containing instructions on the use of material features and the use of digital-based pop up books.

Material Features

The material feature is in the form of a pop up book where, there are several items that can be opened and closed, if it has not been opened and has clicked on the next page, there will be a red notification so that the respondent must read the whole thing first.

Games Features

The games feature is a tooth brushing technique, it is hoped that deaf children after understanding the material features, can implement it in the games feature, by choosing the correct tooth brushing technique for each part of the tooth surface, if you choose the wrong then the background icon of the answer is red and cannot continue to the next game question, while if you choose the correct answer background icon is green and can click the next icon.

Features of Dental Hygiene Maintenance

Dental hygiene maintenance feature, where there are 2 icons, namely the monitoring icon for brushing teeth and the debris control icon. On the monitoring icon of brushing the teeth of deaf children, you must document that when brushing your teeth in the morning after breakfast and at night before going to bed, the photo of the respondent will be entered into the researcher's google drive account, then on the debris control icon use a disclosing solution to stain the debris on the surface of the teeth, and peel each index tooth then fill in the index debris score. In the debris control feature, there is a question mark icon which is the way to fill in the debris control.

Post-Test Features

The post-test feature is the same as the pre-test feature which distinguishes the post-test feature can be accessed at any time, there are 3 parts, namely knowledge in the form of a questionnaire with 12 questions, attitude in the form of a checklist with 8 questions and skills in the form of a checklist with 10 questions.

Rating Chart Features

The assessment graph feature has 4 parts, namely knowledge, attitudes, skills and debris index, which aims for deaf children to be able to monitor independently, scores are obtained from filling in the pre-test, post-test and control debris features. The answers to the questions are automatically entered into the google drive of researchers and dental health workers.

C. Expert Validation

Table 1.
Expert Validation Test Results

Expert Validation				
Name	N	F (%)	Average	p-Value
Health Promotion Expert	18	90	89%	0,968
Exceptional Education Expert	18	96		
IT Expert	18	81		

* Intraclass Correlation Coefficient

Based on the table on the results of the assessment of 3 expert validators, it is known that the distribution is with an average of 89%, which means that the "Pop Up Book" media is suitable as an educational medium in maintaining dental and oral hygiene.

D. Test Model

The implementation of the "Digital-Based Pop Up Book" application test as an effort to improve tooth brushing behavior in deaf children using the Quasi Experiment method with a pre-test and post-test with control group design. This research was conducted at SLBN Semarang as an intervention group and SLBN Ungaran as a control group. This research has the goal of producing a "Digital-Based Pop Up Book" application as an educational medium in increasing changes in the behavior of deaf children in brushing their teeth. Efforts to determine the effectiveness of the application were made in two different groups of tests. The intervention group received treatment with the "Digital-Based Pop Up Book" application, while the control group received a Conventional Pop Up Book. The results of this study were analyzed which were divided into univariate and bivariate data analysis.

Table 2.
Data Normality Test of Intervention Groups and Control Groups

	P-value	
Variabel	Intervention	Control
Pre-test Knowledge	0,095	0,590
Post-test Knowledge	0,009 #	0,042 #
Pre-test Attitude	0,079	0,018 #
Post-test Attitude	0,009 #	0,002 #
Pre-test Skills	0,182	0,165
Post-test Skills	0,023 #	0,017 #
Debris Index Pre-test	0,935	0,632
Debris Index Post-test	0,271	0,022 #

*Shapiro-Wilk
#Abnormal

Based on the table, the results of the normality test for the intervention group showed 3 variables, namely post-test knowledge, post-test attitude, and post-test skills with a p-value of <0.05, meaning that the data was not normally distributed so that it was followed by a non-parametric test, while the other variable showed a p-value of >0.05, meaning that the data was normally distributed so that it was followed by a parametric test.

The results of the normality test in the control group were 5 variables, namely post-test knowledge, pre-test attitude, post-test attitude, post-test skills and post-test debris index with a p-value of <0.05 meaning that the data was not normally distributed so that it was continued with a non-parametric test, while the other variable showed a p-value of >0.05 meaning that the data was normally distributed so that it was continued with a parametric test.

Table 3.
Results of Model Effectiveness Test on Deaf Children's Tooth Brushing Knowledge in the Intervention Group and Control Group

Group	Mean ± SD *Pre-test*	Mean ± SD *Post-test*	Delta (Δ)	p-value
Intervention	9,91 ± 0,944	11,27 ± 0,786	1,36	0,002*
Control	7,45 ± 1,968	8,00 ± 1,844	0,55	0,014*
			p=0,000**	

*Paired test :*wilcoxon
*Unpaired test :**mann whitney

The table shows that the results of the data effectiveness test paired with knowledge of brushing the teeth of deaf children showed a p-value in the intervention group of 0.002 (p<0.05), meaning that there was a difference in knowledge before being given treatment and after being given treatment. The p-value in the control group was 0.014 (p<0.05), meaning that there was a difference in knowledge before being given treatment and after being given treatment.

The results of the data effectiveness test did not match the knowledge of brushing the teeth of deaf children showed a p-value of 0.000 (p<0.05), which means that there was a difference in knowledge after treatment in the intervention group and the control group.

Table 4.
Results of Model Effectiveness Test on Deaf Children's Tooth Brushing Attitude in the Intervention Group and Control Group

Group	Mean ± SD Pre-test	Mean ± SD Post-test	Delta (Δ)	p-value
Intervention	5,91 ± 1,044	7,27 ± 0,786	1,36	0,004
Control	5,82 ± 0,751	6,55 ± 0,688	0,73	0,021
			p=0,047	

*Paired test :*wilcoxon
*Unpaired test :**mann whitney

The table shows that the results of the data effectiveness test paired with the attitude of brushing the teeth of deaf children showed a p-value in the intervention group of 0.004 (p<0.05), meaning that there was a difference in attitude before being given treatment and after being given treatment. The p-value in the control group was 0.021 (p<0.05), meaning that there was a difference in attitude before and after treatment.

The results of the data effectiveness test of unpaired toothbrushing attitudes in deaf children showed a p-value of 0.047 (p<0.05), which means that there was a difference in attitude after treatment in the intervention group and the control group.

Table 5.
Results of Model Effectiveness Test on Deaf Children's Tooth Brushing Skills in the Intervention Group and Control Group

Group	Mean ± SD Pre-test	Mean ± SD Post-test	Delta (Δ)	p-value
Intervention	6,18 ± 1,722	9,09 ± 1,044	2,91	0,007
Control	5,18 ± 0,982	5,91 ± 0,831	0,73	0,033
			p=0,000	

*Paired test :*wilcoxon
*Unpaired test :**mann whitney

The table shows that the results of the data effectiveness test of tooth brushing skills in deaf children showed a p-value in the intervention group of 0.007 (p<0.05), meaning that there was a difference in skills before being given treatment and after being given treatment. The p-value in the control group was 0.033 (p<0.05), meaning that there was a difference in skills before and after treatment.

The results of the data effectiveness test of non-paired toothbrushing skills in deaf children

showed a p-value of 0.000 (p<0.05), which means that there was a difference in skills after treatment in the intervention group and the control group.

Table 6.
Results of Model Effectiveness Test on Deaf Children's Tooth Brushing Skills in the Intervention Group and Control Group

Group	Mean ± SD Pre-test	Mean ± SD Post-test	Delta (Δ)	p-value
Intervention	2,109 ± 0,5029	0,745 ± 0,3671	1,364	0,000
Control	2,173 ± 0,5515	1,427 ± 0,1849	0,746	0,003
			p=0,000	

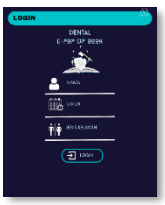
*Paired test : *wilcoxon *** paired t-test
*Unpaired test :***mann whitney

The table shows that the results of the debris index paired data test of deaf children showed a p-value in the intervention group of 0.000 (p<0.05), meaning that there was a difference in the debris index before treatment and after treatment. The p-value in the control group was 0.033 (p<0.05), meaning that there was a difference in the debris index before and after the treatment.

The results of the data effectiveness test showed a p-value of 0.000 (p<0.05), which means that there was a difference in the debris index after treatment in the intervention group and the control group.

E. Product Results

Based on the model design that has been carried out by expert validation tests and effectiveness tests, the results of products that are suitable and effective for deaf children in improving toothbrushing behavior are obtained. The following is a product display "Digital-Based Pop Up Book.



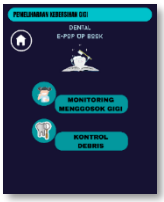
Picture 1. App login view

Picture 2. Pre-Test Features

Picture 3. Main Menu

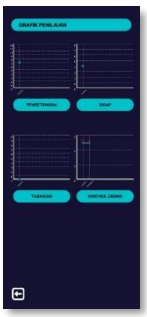
Picture 4. Material Features

Picture 5. Games Features



Picture 6. Features of Dental Hygiene Maintenance

Picture 7. Post Test Features



Picture 8. Rating Chart Features

Discussion

A. The Effectiveness of the Application of Digital-Based Pop Up Book Media on Tooth Brushing Knowledge in Deaf Children

Factors that can affect the process of counseling or delivering an education are the media or tools used, the material delivered and the method to convey the message.[14] Based on the results of previous research which states that the use of media in counseling on the material presented and the method to convey the message.[15]

Technological developments can be used as a solution to develop innovations in the field of learning to make them more interesting. Digital-based pop up book media presents attractive visual images, packaged simply, and uses language or sentences that are easy to understand. Based on previous research, digital-based visual media is effective in increasing knowledge in deaf children.

The increase in knowledge in deaf children is caused by the provision of treatment, namely education using a digital-based pop up book media model for 21 days so that it can make deaf children aware of the importance of maintaining dental hygiene. The increase in knowledge in deaf children is due to the stimulus of information that has been given to deaf children through education that has an influence on knowledge or cognition in deaf children provided through digital-based pop up book educational media that is interesting, clear, and easy to understand, so that stimuli are received and there is attention from individuals so that there is an increase in knowledge in children.[16] In line with someone's research, media using android-based applications is more effective in increasing knowledge because it is more interesting, causing sensory and motor stimulation for children so that learning is not monotonous and boring.[17]

B. The Effectiveness of the Application of Digital-Based Pop Up Book Media on Toothbrushing Attitudes in Deaf Children.

According to Harisnal, the change in attitude in children cannot be separated from the process of knowledge that increases from not knowing to knowing then understanding and changing attitudes.[17] This is in line with previous research that knowledge and attitudes are the basis for the formation of a person's behavior, attitudes are formed after the process of knowing first, and are strengthened by the results of the application of the dental health education model in deaf children to effectively improve the attitudes of deaf children in maintaining dental health.[18]

Attitudes are influenced by knowledge, when knowledge increases, there is also an increase in children's attitudes about how to brush their teeth properly and correctly. Research in China found that children with good knowledge of how to maintain dental health will have a good attitude in maintaining dental health.[19]

C. The Effectiveness of the Application of Digital-Based Pop Up Book Media on Tooth Brushing Skills in Deaf Children.

Deaf children get dental health education with a digital-based pop up book media model this can improve the skills of deaf children in brushing their teeth, in the application there are also games of brushing teeth techniques so that children can better understand the techniques of brushing teeth from the material obtained, so that children go from knowing to wanting and can improve children's attitudes, From increased knowledge and attitudes, the skills of deaf children in brushing their teeth also increased. In addition to the application of the dental health education model, deaf children also apply toothbrushing skills at home 2x a day, namely in the morning after breakfast and at night before going to bed, then upload photo evidence of tooth brushing activities.

The formation of behavior with regular brushing skills for 21 days will form a new behavior of children's habits in brushing their teeth.[19] In this study, toothbrushing skills were provided through digital-based pop up book media, then the documentation of tooth brushing skills in the morning after breakfast and the night before going to bed, namely the respondents uploaded evidence of brushing activities on a digital-based pop up book application for 21 days. The data that has been uploaded by the respondent automatically enters the operator's system for monitoring.

D. The Effectiveness of the Application of Digital-Based Pop Up Book Media on Debris Index in Deaf Children.

The decrease in the debris index score in deaf children in this study was due to the treatment carried out not only through promoters but also with the respondents' compliance in routine brushing their teeth at home and the results of the debris index examination.

There is a study on a decrease in debris index scores in children because after the administration of DHE (dental health education), the continuous administration of DHE for 21 days will change the knowledge, attitude, and skills of the respondents. Children's dental and oral hygiene is related to the child's behavior in maintaining dental hygiene. In addition, monitoring tooth brushing activities will be able to affect the skills carried out by respondents so that toothbrushing activities that are carried out regularly twice a day, morning after breakfast and at night before going to bed will be able to reduce the debris index score.[20]

Conclusion

Brushing behavior has a huge impact on the condition of dental and oral hygiene. The "Digital-Based Pop Up Book" is effective and feasible as an effort to improve tooth brushing behavior in deaf children and dental health workers in schools can be implemented as a medium to promote dental hygiene in target schools, so that it is expected to overcome the problem of dental and oral hygiene of deaf children.

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